

Advanced Technologies to Improve Closure of Life Support Systems

Daniel J. Barta, Ph.D.

NASA Johnson Space Center, Mail Code EC1, Houston, Texas, 77058, USA

As NASA looks beyond the International Space Station toward long-duration, deep space missions away from Earth, the current practice of supplying consumables and spares will not be practical nor affordable. New approaches are sought for life support and habitation systems that will reduce dependency on Earth and increase mission sustainability. To reduce launch mass, further closure of Environmental Control and Life Support Systems (ECLSS) beyond the current capability of the ISS will be required. Areas of particular interest include achieving higher degrees of recycling within Atmosphere Revitalization, Water Recovery and Waste Management Systems. NASA is currently investigating advanced carbon dioxide reduction processes that surpass the level of oxygen recovery available from the Sabatier Carbon Dioxide Reduction Assembly (CRA) on the ISS. Candidate technologies will potentially improve the recovery of oxygen from about 50% (for the CRA) to as much as 100% for technologies whose end product is solid carbon. Improving the efficiency of water recycling and recovery can be achieved by the addition of advanced technologies to recover water from brines and solid wastes. Bioregenerative technologies may be utilized for water reclamation and also for the production of food. Use of higher plants will simultaneously benefit atmosphere revitalization and water recovery through photosynthesis and transpiration. The level at which bioregenerative technologies are utilized will depend on their comparative requirements for spacecraft resources including mass, power, volume, heat rejection, crew time and reliability. Planetary protection requirements will need to be considered for missions to other solar system bodies.